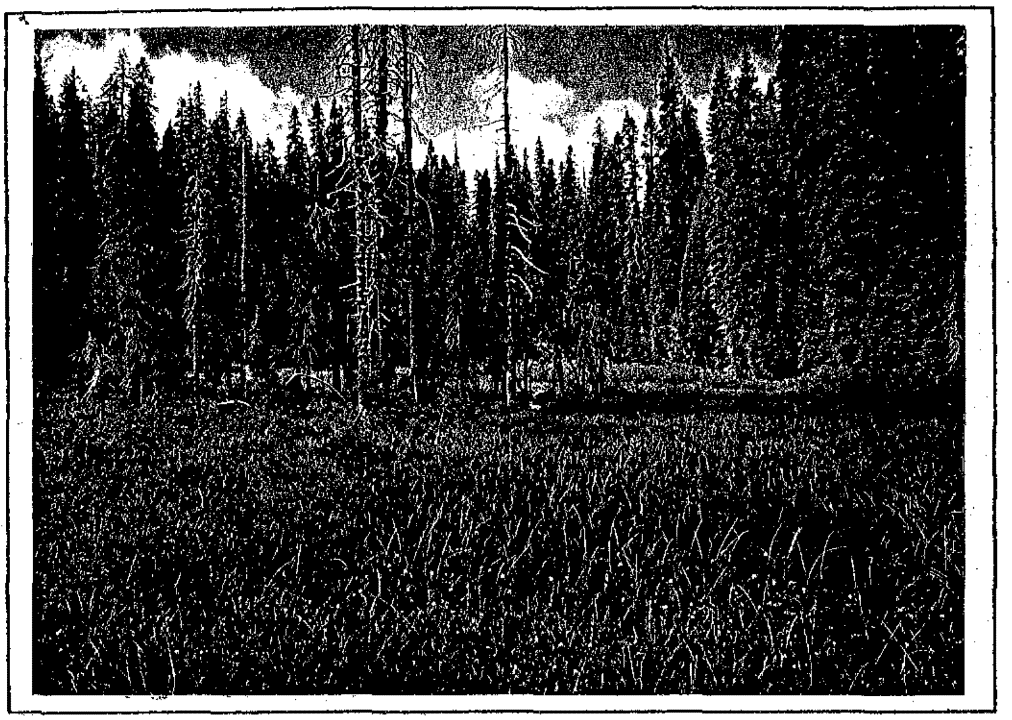
ECOLOGICAL SURVEY OF THE PROPOSED



HAYPRESS MEADOWS RESEARCH NATURAL AREA

SAF TYPE 207 (RED FIR)
KLAMATH NATIONAL FOREST

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Fort Collins CO 80526

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Pacific Southwest Forest and Range Experiment Station
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MAY 1988

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COVER PHOTO Haypress Meadow #2; the largest of the wet meadows in the study area; Shasta fir, lodgepole pine, mountain hemlock, white pine along the border.

INTRODUCTION

This report is the result of an ecological field survey of the proposed Haypress Meadows Research Natural Area, located at the western edge of the Marble Mountain Wilderness Area, on the Ukonom Ranger District, Klamath National Forest.

The Haypress Meadows candidate was nominated by the Klamath National Forest (Klamath National Forest 1987) to meet the target SAF type #207 (Red fir) RNA requirement for the Klamath Mountains Physiographic Region. Informal field review and mapping of the boundary was conducted by Linda Barker (Klamath National Forest) and David Diaz (Region 5 office). No formal preliminary reconnaissance of the area was conducted.

Forests of the area are primarily mixed white fir and Shasta red fir, and generally referred to as Mixed Conifer Forest. Douglas-fir, mountain hemlock and sugar pine are secondary species. The area also includes a series of well-developed montane wet meadows, that include Ross, Lone Pine, and Albers Meadows (together referred to as Ti Creek meadows), the Haypress Meadows, and numerous smaller meadows. A small amount of dry meadow occurs that appears to be the vestige of extensive cattle grazing in the area during the late 1800's and early 1900's. Many features of the area are named after early ranchers of the region, such as Ross, Stanshaw and Albers Meadows, who used the high country for summer range. Range use of the area peaked about 1915, when 3200 head were reported using the large allotment in the western Marbles that included Haypress Meadows (Atwood 1988). By 1964, when the Marble Mountain Wilderness Area was established, cattle use had declined to about 170 head. Since about that time, grazing has been held to roughly 55 head. Vegetation patterns in portions of the area, primarily the meadows, now reflect the long history of cattle use. Of far greater importance in determining the present structure of vegetation is fire, in which man may have played an important role.

For additional and specific background on the vegetation, mosses, fungi and other plants of the study area and Marble Mountain Wilderness in general, see Green (1980), Stillman (1980), Spjut (1971), Regalia (1978), and McLauchlin (1984). Arnold and Reed (1980) provide an interesting account of life in the Somes Bar-Orleans area around the turn of the century, and speak frequently of the Haypress Trail and area in general.

Methods. Field survey of the approximately 1250 acre study area was conducted June 4-6, and July 21-24, 1988. A majority of the area was observed on the ground by traversing the range of vegetation types and notable features present. All plants not immediately recognized were collected for later determination using Munz (1959) and Hitchcock (1950). Taxonomic nomenclature follows Smith and Sawyer (1987). A list of all vascular plants encountered in the survey is included in Appendix A. Vegetation was sampled using standard Region 5 Forest Service Handbook 2090 methods for ecosystem classification (Allen and Diaz 1986). Data reported in Table 1 are based on (20) 1/10th acre circular plots, sampled within representative stands of each of the major forest types within the Red Fir Zone. Depth and texture of soils were determined with a 36" soil sampling tube. Trees were aged with an 18" increment core. Random timber data not reported in Table 1 were taken to characterize stand age structure and to develop descriptions of the vegetation types. Aerial photos (1980) were used to map the vegetation types and delineate the features.

LOCATION AND ACCESS

The candidate is located on the western edge of the Marble Mountain Wilderness, Siskiyou County, California (T13N/R7E/sections 17,18,19,20; Latitude 41d/31m, Longitude 123d/22m, Humboldt Meridian), at the headwaters of Cub, Ti and Haypress Creeks (Figure 1). The area is approximately 8 miles east of Somes Bar, 20 miles due south of Happy Camp, and 75 miles west of Mt. Shasta.

As proposed, the area is bound by trail 6E14 to the west and south, the Wilderness boundary to the north, and trail 7E12 to the east, as far north as about the midpoint of Long Meadow. From this point, the boundary was assumed to run due north, across the top of the small peak, to the Wilderness boundary (Figure 2).

Primary access to the area from Interstate 5 is provided by State Highway 299 at Redding, west to Willow Creek, then Highway 96 north to Ti Bar or Somes Bar. From Ti Bar, take Forest Service roads FS13N11 and 14N01 for 14.4 miles to the Ten Bear junction. From this point, a variety of access routes via FS15N17 are available (Figure 1):

1) Right 0.2 miles to FS13N45 on the left; 0.1 miles to locked gate; walk 0.5 miles by road to 6E14 trailhead; walk trail 800' south to the northwestern corner of the study area.
2) Right 1.7 miles to the base of an old unmarked trail (shown on the 1983 Ukonom Mtn. 7.5' USGS quadrangle map) that is opposite spur road FS15N17-2G; the trail generally follows the ridge to the east for .75 miles where it intersects trail 6E14 just north of Albers Meadow, near the southwestern corner of the study area; this trail is not visible in some portions.
3) Right 1.3 miles to where the road runs closest to the study area (and Wilderness) boundary; walk due east up a small draw about 0.2 miles to the northern Ross Meadow;
4) Right 4.0 miles to the Stanshaw trailhead (7E10); walk 1+ mile to intersect trail 6E14 south of Jawbone Camp, at the southwestern corner of the area.
5) Right 6.0 miles to FS15N17-2E on the left; 1.3 miles to 11W21 trailhead; walk 2.0 miles to Haypress Meadows at the southeastern corner of the study area.

A less favorable route of access is FS15N17 (Offield Mountain Road) from Somes Bar, but this is a slower route.

PHYSICAL ENVIRONMENT

Topography

The Marble Mountains are part of the dissected remnants of the Klamath Peneplain, that covered much of northwestern California. Overall, topographic relief in the study area is relatively gentle. Elevation ranges from 4400' at the center of the northern boundary, along Cub Creek, to 5400' on some of the ridges in the southern portion (Figure 2). The majority of the area lies between 4800 and 5200'. The steepest slopes are associated with the headwaters of Cub Creek, the major drainage running south to north in the eastern portion of the area. Slopes for the most part range 0-60%, with a series of flats supporting a diverse meadow complex, mostly in the southern half of the area.

Climate

Climate of the area is cool Mediterranean, the majority of precipitation falling between October and May. Climate is moderately marine-influenced, which

generally distinguishes this subregion from the eastern subregion of the Klamath Mountains Physiographic Region (Sawyer and Thornburgh 1977). Weather data are available for Orleans, located at about 450' elevation and 14 miles to the southwest: average annual precipitation there is 47"; average January temperature is 39 degrees F. (minimum 8 degrees recorded); average July temperature is 73 degrees F. (maximum 117 recorded) (NOAA 1974). Precipitation at the study area probably ranges 50-60", with a significant portion falling as snow. Winter temperatures undoubtedly range below freezing for significant periods. Snow banks undoubtedly remain well into the spring, particularly in the drainages and on north slopes. No snow remained in June, 1987, an especially dry year.

Geology

The Marble Mountains constitute an igneous intrusion of Late Jurassic or Early Cretaceous age, within much older rocks associated with the Western Paleozoic and Triassic Subprovince (Bailey 1966). Topographic differences between the Marble Mountains and the heavily glaciated Trinity Alps to the south suggest that glaciation was of minor importance regionally (Stillman 1980). Pratt (1964) describes the geology of the Marble Mountains in detail. Granite and diorite were the only parent materials noted in this survey.

Soils

Soils over the entire area were classified as Entic Xerumbrepts-Gerle Family-Tallac Family association 15-50%, in the Klamath National Forest 3rd order survey (Foster and Lang 1982).

A major component in this association are the Entic Xerumbrepts, shallow and often excessively drained soils associated with upper sideslopes and ridges. Vegetation on these soils is generally sparse fir or dense scrub. Typical Entic Xerumbrepts have a dark A horizon 5-10" deep, gravelly sandy loam in texture and strongly acid; this horizon is directly underlain by a 4-9" C horizon, when present, that is gravelly loamy sand or loamy sand in texture. Parent material is soft weathered granodiorite, usually at less than 20" deep.

The other major group of soils present is the Gerle Family (Typic Xerumbrepts) consisting of moderately deep or deep residual soils associated with sideslopes, footslopes and ridges. Vegetation here is mostly true fir and mountain hemlock. These soils typically have a dark A horizon 11" deep, gravelly fine sandy loam in texture, and slightly acid, and usually are underlain by a yellow B horizon of similar texture down to 20". The C horizon is very gravelly fine sand, and extends to 35" where it grades to soft weathered granodiorite.

Potential for regeneration is rated very low to moderate, and productivity moderate to moderately high for this association. Available water is usually low, and susceptibility to compaction low to moderate.

The depth of the solum (A+B horizons) in this survey ranged up to 30", with A horizons ranging to 8" deep (Table 1). Soils were usually deepest and wettest in the *Shasta red fir/vanilla leaf forest*; in one stand the soil was saturated at 10". Soils were generally shallowest, and appeared driest in the *Shasta red fir/princes pine forest*. In many cases, no A horizon was apparent, particularly in the depauperate stands surrounding the Haypress Meadows area. Soils associated with the *Pussy paws/western needlegrass dry meadow* areas usually exhibited no A horizon.

In nearly half of the soils sampled, a gray/light brown horizon 1-2" thick lay near or at the surface, which was composed of microscopic charcoal, fungal mycelia and soil particles. This characteristic seemed less prevalent in the *Shasta red fir/vanilla leaf* and *Shasta red fir/thinleaf huckleberry forest*, and may reflect repeated or intense fire.

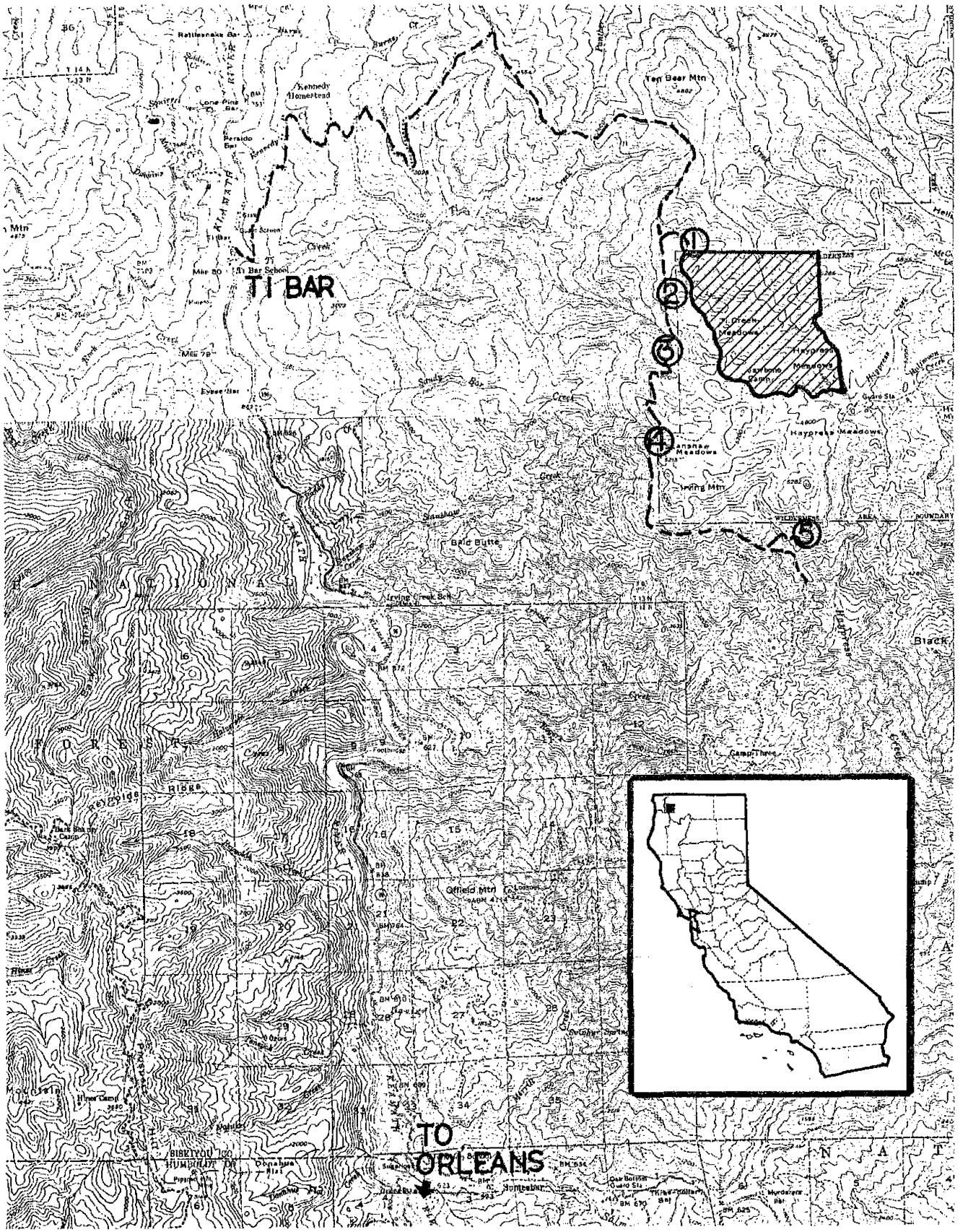


FIGURE 1. Regional map and primary access routes; see p.2 for explanation.

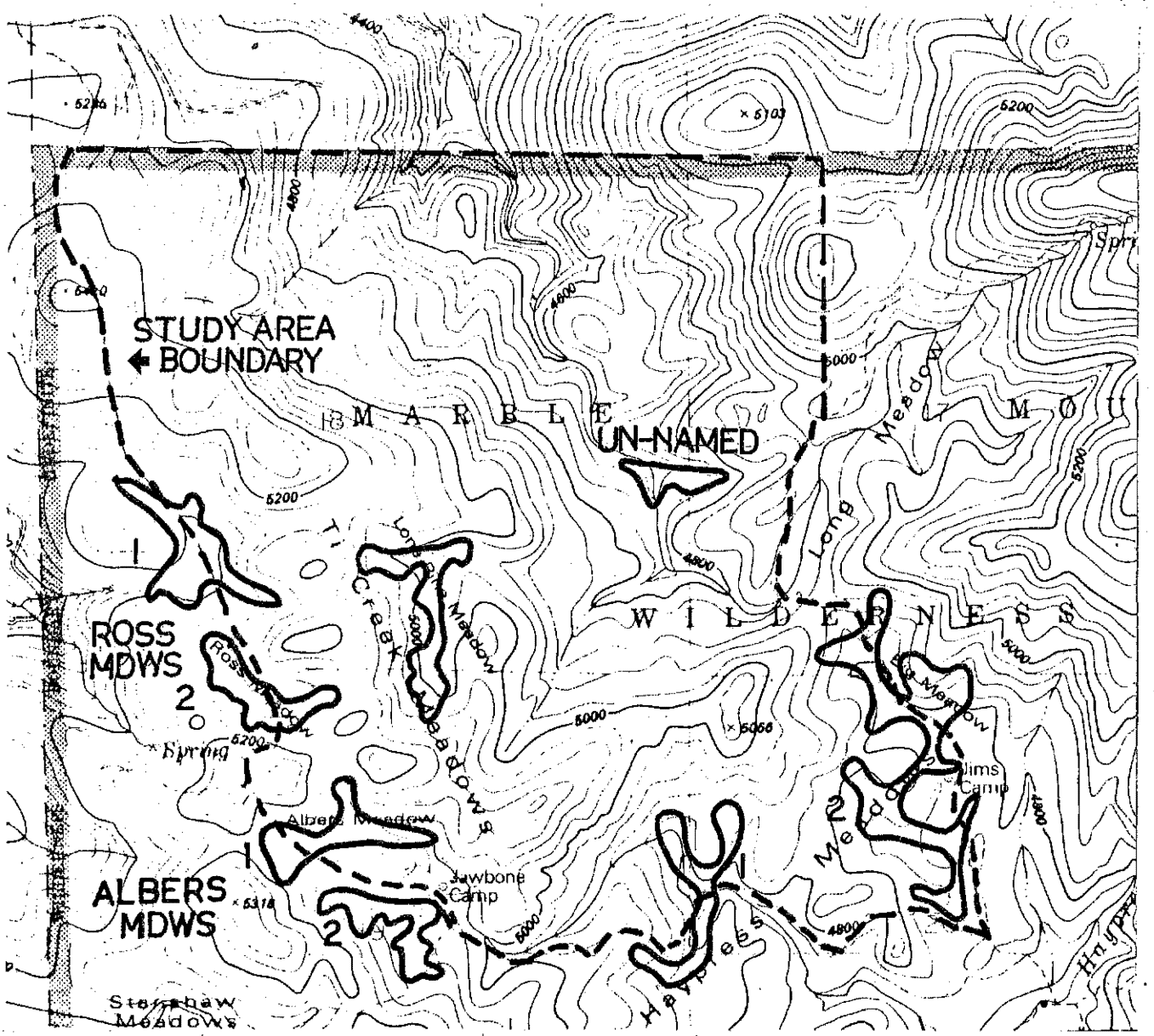


FIGURE 2. Topographic map of the study area; major meadows are identified.

Flora

General. Overall the flora of the Klamath Mountains is floristically rich, due in part to its large endemic flora and its relictual status (Sawyer and Thornburgh 1977). Brewer spruce and Sadler oak are examples of species endemic to the Klamath Mountains. The vegetation of the candidate area is representative of the diverse vegetation and flora found in this region. A total of 12 conifer species, and over 200 other vascular plant species were encountered in this survey. The floristic richness of the area is demonstrated by comparison with an area of even greater size (~1800 acres) and elevational range (6000-8400') on the southern slope of Mt. Shasta, 75 miles to the east (Imper 1988). The proposed Shasta Red Fir RNA includes three vegetation zones (Alpine, Subalpine, Red Fir), yet species diversity was exceptionally low. Only seven conifers and some 80 other vascular plant species were noted during the week long reconnaissance. As expected, little floristic overlap exists between these two areas, since two different floristic provinces are represented (Sierran vs. Pacific Northwest), as well as differences in climate and substrate.

Plant species of special interest. No federal, state or sensitive-listed plant species were encountered in the study area, although three former sensitive species and a number of species listed as rare, endangered, or having limited distributions by the California Native Plant Society (CNPS 1984) were found. In addition, two interesting and perhaps uncommon hybrids were encountered. These plants of interest include:

Lupinus tracyi. This plant was formally considered sensitive by the Forest Service, but was delisted due to abundance and lack of threat. The species is endemic to northern California, and is now included on CNPS List #4 (Plants of Limited Distribution). Within the study area, *Lupinus tracyi* is confined to the *Shasta red fir/thinleaf huckleberry forest* in the vicinity of Jawbone Camp.

Lilium wigginsii. Wiggin's lily was also listed as sensitive, but was delisted in conjunction with a species monitoring plan developed on the Klamath National Forest. The species is now included on CNPS List #4. Wiggin's lily occurs scattered along many of the small drainages, and at the edges of many of the wet meadows in the area, always in wet but non-stagnant sites.

Epilobium oreganum. The Oregon willow-herb was recently removed from the Region 5 Sensitive Plant List. The plant occurs in several of the wet meadow areas.

Carex halliana. This species is reported from only a few locations in California, and is currently included on CNPS List #2 [(Rare or Endangered in California-More Common Elsewhere (Oregon)]. The plant occurs in several of the dry meadows in the southeastern corner of the area.

Veronica cusickii?. Plants appearing to be this species, but perhaps actually *V. copelandii*, were found in several of the wet meadows in the area. Both species are included on CNPS List #4 (Plants of Limited Distribution).

Gentiana setigera. This species occurs in many of the wet meadows in the area. The species is currently included on CNPS List #3 (More Information Needed), but may be included on List #2 in the future.

Collinsia linearis. This species is included on the CNPS List #4 (Plants of Limited Distribution), and occurs on the rocky barren slope at the northeastern corner of the area, associated with the *Shasta red fir/pinemat manzanita forest*.

Veratrum californicum X V. viride. The hybrid between these two species was encountered growing with the parent plants in Haypress Meadow #2. The two species rarely occur together.

Vaccinium membranaceum X V. uliginosum ssp. *occidentale*. This is an interesting hybrid produced from *V. uliginosum*, which is confined to the wet meadows of the area, and *V. membranaceum*, which is confined to forested areas. The hybrid was collected along the trail near Long Meadow, and shows a nice gradation in foliar and flower characteristics.

Shasta red fir taxonomy. There is much confusion about the identification and distribution of red fir, Shasta red fir and noble fir, collectively referred to as the "noble and red fir complex", particularly in the Coast Ranges of northwestern California and southern Oregon. In general, "true" noble fir is thought to occur as far south as 44 degrees north latitude in central Oregon; California red fir is considered to be restricted to the Sierra Nevada; and the highly variable populations in northern California and southern Oregon roughly between 40-44 degrees north latitude are considered transitional between the other two, and generally associated with Shasta red fir (Franklin 1978; Zavarin et al. 1978). Noble and red fir are highly interfertile, which has led some to speculate about the possibility of hybrid origin for Shasta red fir.

The three groups have in the past been segregated primarily on differences in cone and leaf morphology, and geographical distribution. One of the more easily recognized characteristics is cone bracts: noble fir has long reflexed bracts that sheath the cone scales; red fir has bracts shorter than the scales, i.e., not exserted; and Shasta red fir bracts are intermediate between the other two. Another characteristic often used is number of cotyledons: noble fir ranges from 4-6; red fir from 6-13; and Shasta red fir from 5-8 (Franklin 1961). Noble fir tends to grow in cooler and wetter climates, and on more fertile and finer textured soils than the other two (Franklin 1978). Noble fir also appear to be less shade tolerant, produce more seed at an earlier age, and have more rapid germination rate than Shasta red fir (Minore 1979).

Red fir stands in the study area and Marble Mountains in general are considered closest to Shasta red fir (Regalia 1978; Sawyer 1988). However, there is some controversy over the identification of the "transitional zone" trees more closely with *Abies magnifica* than *Abies procera*. In many cases, cones from this area are similar if not identical to noble fir cones (Zavarin et al. 1978). Fir stands located 30 miles south of the study area, at the western edge of the Trinity Mountains are considered to be noble fir (Sawyer 1988), which is to some extent supported by analysis of foliar monoterpenes (Zavarin et al. 1978). Although few cones were available for inspection during this survey, several were found with highly exserted bracts, typical of noble fir. Cotyledon number generally ranged 5-7, which could reflect either noble or Shasta red fir.

Another measure that might be used to measure similarity to either noble or Shasta red fir is comparison of the ecological behavior of Shasta red fir at Haypress with typical Shasta red fir stands on Mt. Shasta (Imper 1988), and in particular, their relationship to mountain hemlock. In both cases, mountain hemlock is confined to streamside zones or cool northern slopes. At Mt. Shasta, Shasta fir forms pure stands on the adjacent slopes; white fir and Douglas-fir become important generally below the lower elevational limit for mountain hemlock. In the Haypress area, Shasta fir is the dominant overstory species in

only one vegetation type, the same type that includes mountain hemlock. Thus, assuming mountain hemlock behavior is comparable between the sites (and this may not be true), Shasta fir at Haypress would appear to behave more like noble fir than true Shasta red fir.

In summary, some evidence of noble fir-like characteristics was found in the study area. However, cone morphology is notoriously variable in this group, and though ecological behavior might be a useful tool for gauging taxonomic affiliation, these studies must be more extensive and broader in scope than was possible here. Therefore, stands are characterized as Shasta red fir, realizing that an accurate assessment of the taxonomic status of red fir in the study area should be further investigated.

Vegetation

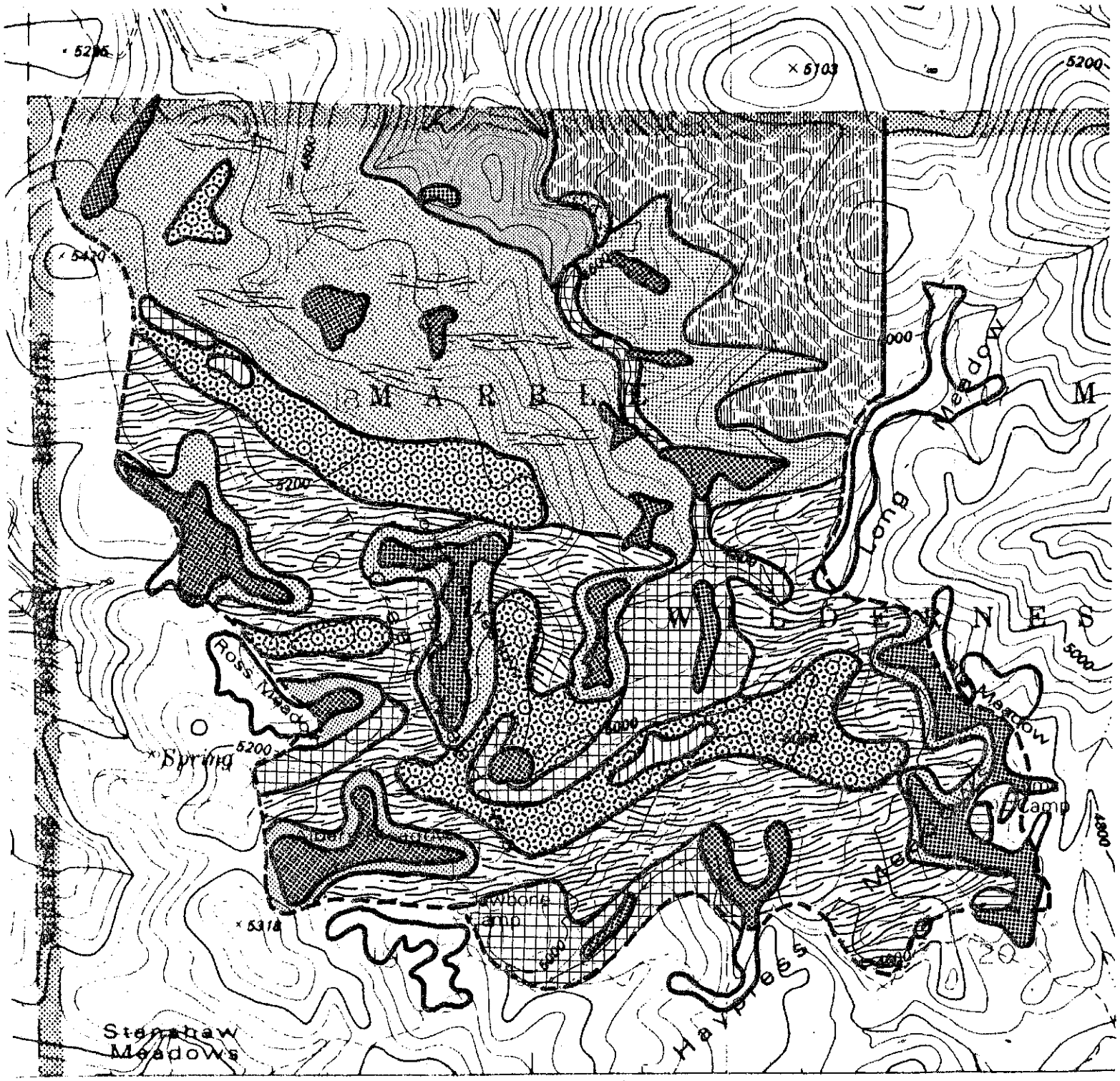
General. The vegetation of the Klamath Mountains has attracted widespread interest, due to its refugial nature, high floristic diversity and complex vegetation patterns. The study area occurs in the western subregion of the Klamath Mountains Region, as defined by Sawyer and Thornburgh (1977), which is subject to more maritime climate compared to the eastern subregion. Four elevation zones are recognized in this subregion, named after dominant climax trees of mesic habitats; with increasing altitude, these are white fir, red fir, mountain hemlock, and whitebark pine.

Two zones are represented in the study area, the White Fir and Red Fir Zones. Although mountain hemlock is common in the southern portion of the study area, its occurrence is patchy, and restricted to drainages or otherwise cool, moist sites. These stands are at the lower elevational limit for mountain hemlock in this vicinity, and hemlock is almost always an understory component in otherwise Shasta fir stands. Hemlock is therefore considered a local variant in the Shasta red fir forest, even though overtime, these stands may become increasingly dominated by mountain hemlock.

Classification of red fir and white fir forest types on the Six Rivers and Klamath National Forests is ongoing, and preliminary ecological types for the Red Fir series have been described (Jimerson 1986). Many of the types described here for the study area are similar to ecological types described on the Six Rivers National Forest. Where appropriate, cross reference is made to these types, or to broad regional types described for the Klamath Mountains by Sawyer and Thornburgh (1977).

Overall, about 235 acres or 20% of the area is considered to represent the White Fir Zone. The remainder is described as Red Fir Zone, although Shasta fir is dominant in the overstory in only one forest type, covering about 110 acres or 8% of the area. In the other types, Shasta fir usually dominates the regeneration, but varies from less than 5% to 50% of the overstory, usually codominant or subordinate to white fir. Shasta fir requires at least some site modification to establish in the majority of the forest present, a function of the relatively low elevation. Initial cover is usually provided by white fir, after which openings resulting from fire, mass failure, or general mortality of white fir allow establishment of the more shade-intolerant Shasta fir. This aspect of Shasta fir behavior was examined by Regalia (1978) in the Haypress Meadows area.

Eight forest types, one scrub type, and a complex of dry and wet meadow types are described for the study area (Figure 3; Table 1). Estimates of proportional coverage are included in Table 2.



KEY

WHITE FIR ZONE

- White fir/vanilla leaf forest
- White fir/princes pine forest
- White fir/pinemat manzanita forest

RED FIR ZONE

- Shasta red fir/thinleaf huckleberry forest
- Shasta red fir/Sadler oak forest
- Shasta red fir/vanilla leaf forest
- Shasta red fir/princes pine forest
- Tobacco brush-greenleaf manzanita scrub
- Pussy paws/western needlegrass dry meadow
- Wet meadows

FIGURE 3. Vegetation map of the study area.

Table 1. Vegetation classification and timber data (order table) for the primary forest types, proposed Haypress Meadows RNA; see next page for explanation of abbreviations; EDP species codes reflect first 2 letters of genus and epithet (see Appendix A)

	Shasta red fir/ vanilla leaf forest				Shasta red fir/ thinleaf huckleberry forest							Shasta red fir/ Sadler oak forest			Shasta red fir/ princes pine forest					
PLOT	15	20	18	2	3	19	4	5	12	13	14	11	17	1	7	9	16	6	10	8
ELEV	5100	4920	5040	5140	4750	4880	5040	5000	4900	4900	4900	4860	5100	4950	4760	4780	5180	4960	4900	4780
ASPECT	210	342	300	30	50	340	360	320	30	180	335	180	90	40	220	350	152	160	210	180
SLOPE%	30	35	20	50	30	60	3	25	50	40	30	30	30	35	20	30	30	40	15	25
MPOS	4	4	4	2	3	4	0	2	3	4	4	2	2	2	3	3	2	2	3	3
HRLF	3	4	2	4	4	1	2	4	2	4	2	4	2	4	1	4	4	1	2	4
VRLF	2	4	2	2	4	1	2	4	2	4	1	4	2	4	1	4	4	1	2	4
BARE%	1	0	0	5	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
GRVL%	1	1	1	1	1	1	0	0	2	1	2	0	0	0	0	0	1	0	0	0
ROCK%	5	2	3	4	15	3	2	1	2	2	3	0	1	1	0	0	7	2	0	0
TVEG%	90	99	90	90	95	98	95	95	98	98	95	95	99	99	90	90	90	85	95	85
MOSS%	2	1	1	0	5	1	2	0	3	0	1	0	1	0	0	0	3	1	0	0
LIT%	90	96	96	90	80	95	95	99	92	97	94	100	98	99	100	100	90	97	100	100
SOILDEP	30		24	30		12	20	18	15	16	16	22	14		20	16	16	18	18	16
AHORIZ	6		6	2		1	8	6	3	4	3	3	1		2	1	3	6	1	2
TGRAM%	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
TFORB%	80	80	55	15	10	25	30	25	6	20	15	15	12	12	30	50	40	35	35	3
TSHRB%	4	10	2	40	75	80	20	95	85	90	85	90	90	85	40	11	20	35	1	0
TTREE%	80	80	80	75	60	70	85	60	75	80	70	80	80	80	85	65	70	75	85	85
:OVERSTORY TREES																				
ABMAS	5tm	20tm	10t	25t	10tm	45tm	65t	50tm	40tm	60tm	50tm	35tm	15tm	35tm	45tm	40tm	8tm	10tm	35tm	5tm
ABCO	45tm	40tm	40tm	40tm	40tm	20tm	10tm	25tm	10tm	10m		20tm	25tm	35tm	20tm	30tm	50tm	45tm	35tm	80tm
PILA			15t	10t	5tm			10t	20t	15t	20t		15t	10t			5t	25t		
PSME		15tm			10tm								15t					1m		
TSME						4m	20tm		5m		15m									
CADE	25tm	5m			1m					1m			4m				5t			
PIJE					5t															
PIMO							5m	2tm												
PICO							3tm													
CHCH					2m								4m					2m		
:UNDERSTORY TREES																				
UABMAS	1\5	4\3	5\3	3\4	3\3	2\4	4\3	20\2	10\3	2\4	3\4	15\2	15\2	4\3	15\1	2\4	2\4	10\2	20\1	
UABCO	2\4	2\4	1\4	2\4	3\3	2\4		3\4	3\3	2\4	3\4	2\4	2\4	2\4	15\1		1\5	10\2	1\5	
UPILA					1\5								1\5				1\5	1\5		
UPSME		1\5			1\5															
UTSME						1\5	5\1		1\5		2\4					1\5				
UCHCH			1\5		1\5							1\4			1\5				1\5	
:SHRUBS																				
ACGL				1\5	2\5															
PAMY		1\1			3\1															
BENE	1\1	3\1			1\1															
ROGY	1\3	5\2	2\2	2\1	1\1					2\2			2\3	1\1						
SOCA						1\1	1\10		2\8	1\4										
RULA		5\1	3\1			6\1	8\1	5\1	1\1	3\1						2\1				
GAOV						1\1	2\1		3\1	4\1	10\1									
VAME					3\2	45\3	5\2	8\1	15\1	40\3	40\3					1\1				
QUSA				40\4	70\3	50\5	15\5	80\6	80\5	80\5	60\5	90\5	85\5	80\5	30\5	10\5	20\5	35\5		
SYMO		2\1		2\1							2\1		1\1		10\1	1\1	1\1		1\1	
ARNE													3\1	1\1						
:FORBS																				
VISH	1\4																			
VIGL	1\3		1\5																	
ANDR	2\1			1\4																
FRCA	2\1	1\3																		
SMST	1\1		1\4																	
ACTR	60\1	30\1	20\1	5\1	3\1	2\1														
LIBO		40\1		1\4	2\1	15\1														
PERA		1\1		1\4						1\4										

Table 1. (Continued)

	Shasta red fir/ vanilla leaf forest				Shasta red fir/ thinleaf huckleberry forest							Shasta red fir/ Sadler oak forest			Shasta red fir/ princes pine forest					
PLOT	15	20	18	2	3	19	4	5	12	13	14	11	17	1	7	9	16	6	10	8
FORBS (Continued)																				
CLUN	2\1	3\1	1\4			2\1	5\1													
VAME	2\1	5\1								3\1										
PSAN				1\5								1\5				1\5	2\3	2\3		1\5
CHUM	10\1	5\1	25\1	10\1	7\1	5\1	6\1	15\1	5\1	20\1	15\1	10\1	10\1	10\1	30\1	40\1	35\1	35\1	35\1	3\1
COspp.		1\5	1\5									1\5					1\5			
PYSE	1\4	2\1	2\1		1\5	2\1	4\1	1\3	1\3						1\2	5\1	1\4		2\1	1\1
GOOB					1\4		1\4	1\4											1\4	1\5
PYPI	1\3		1\4	1\3	1\3														2\4	
PTAQ		2\1	3\3							1\4		2\4					1\5	5\1		
APPU					1\4				1\3			5\1	2\1	2\4		1\1				
STJA			1\1		1\5											1\4				1\5
HIAL	1\4				1\5	1\2														
;GRAMINOIDS																			2\4	
BRVU	2\2	3\1	1\4													1\4	1\3			
CARO																				
TIMBER DATA																				
TOTBA	330	360	330	250	200	250	280	190	160	320	280	150	170	220	260	260	310	300	210	360
DBH																				
:ABMAS			50	35\32		48	20\18	40							56		40			
:ABCO	41			33	32													43\10		25\20
:PSME		50			42															
:TSHE						30\10	18													
HEIGHT																				
:ABMAS				100\100			90\84	140							170					
:ABCO	155			110														130\-		125\-
:PSME																				
:TSME							95													
AGE																				
:ABMAS			200	220\182		220	98\87	190							255		250			
:ABCO	200			210	240													285\72		155\180
:PSME					295															
:TSME						275\180	95													

Explanation of abbreviations used in Table 1; (see FSH Handbook 2090, Methods for Ecosystem Classification for additional explanation [Allen and Diaz 1986]); plots are 1/10th acre circular.

ELEV	Elevation (feet)	OVERSTORY:	
MPOS	Microposition (1=ridge; 2=upper third; 3=middle third; 4=lower third)	3\tm (example)	Canopy cover\canopy position (t=tallest; m=midstory)
HRLF	Horizontal microrelief (1=convex, 2=linear, 3=concave, 4=complex)	UNDERSTORY:	
		3\4 (example)	Canopy cover\abundance class (1=500+; 2=251-500; 3=101-250; 4=11-100; 5=1-10 individuals)
VRLF	Vertical microrelief (same as HRLF)		
BARE%	Bare ground cover	SHRUBS:	
GRVL%	Gravel cover (0.5cm - 8.0cm)	35\1 (example)	Canopy cover\average shrub height
ROCK%	Rock cover (>8.0cm)		
TVEG%	Total vegetation cover	FORBS AND GRAMINOIDS:	
LIT%	Litter cover	2\1 (example)	Canopy cover\abundance class (same as understory)
LITTHK	Average litter thickness		
TGRAM%	Total graminoid cover	TIMBER DATA:	
TFORB%	Total forb cover	TOTBA	Total basal area (sfa)
TSHRB%	Total shrub cover	DBH	Diameter at breast height (inches)
TTREE%	Total tree cover	DOM HT	Dominant tree height (feet) in upper (T1) and lower (T2) layer of overstory

Table 2. Estimated total acreage of vegetation types within the proposed Haypress Meadows RNA.

Vegetation type	Acres	%Area
White Fir (*Abies concolor* Zone:		
White fir/vanilla leaf forest	105	8
White fir/princes pine forest	125	10
White fir/pinemat manzanita forest	3	<1
Red Fir (*Abies magnifica* Zone		
Shasta red fir/thinleaf huckleberry forest	110	8
Shasta red fir/Sadler oak forest	140	11
Shasta red fir/vanilla leaf forest	310	25
Shasta red fir/princes pine forest	310	25
Tobacco brush-greenleaf manzanita scrub	6	<1
Pussy paws/western needlegrass dry meadow complex	7	<1
Wet meadow complex	136	11
Total	1250	100

White Fir Zone. Forest in which white fir is dominant in the understory and a major component in the overstory are considered representative of the White Fir Zone. This zone covers much of the northeastern corner of the area, as well as the south-faced slopes of many of the ridges throughout. Elevation extends to about 4700' elevation on cool northern exposures, and to 5200' on warm southern exposures. Three forest types are described in this zone:

White fir/vanilla leaf forest. The *White fir/vanilla leaf forest (Abies concolor/Achlys triphylla)* occupies about 105 acres on the relatively cool moist slopes above Cub Creek. Elevation ranges from 4400' at the low northern boundary of the area, to over 5100' on the southwest-faced slope in the northeastern corner. Douglas-fir and incense cedar are frequent codominant overstory species. The understory is lush, with well-developed shrub and herb layers. The ground surface is often quite rocky. Stands tend to be relatively uneven-aged, reflecting the minor importance of fire, compared to the other types in this zone. This forest is generally analogous to the *Abies concolor/Trillium ovatum* type described by Sawyer and Thornburgh (1977). On northern exposures, this forest grades to an equivalent type farther upslope in the Red Fir Zone, that is more clearly dominated by Shasta fir in the understory.

White fir/princes pine forest. The *White fir/princes pine forest (Abies concolor/Chimaphila umbellata)* covers about 125 acres, mostly on dry upper slopes in the southeastern corner of the area. Additional stands are scattered on the south-faced slopes of several of the ridges throughout the area. This forest is characterized by almost pure stands of white fir, with local concentrations of Douglas-fir, sugar pine and incense cedar, and occasional ponderosa or Jeffrey pine. Shasta fir occurs in more mesic sites. The understory is depauperate compared to the *White fir/vanilla leaf forest.* Often only occasional individuals of *Rhamnus purshiana, Chimaphila menziesii, or Pteridium aquilinum* are present. Older stands include scattered mats of *Chimaphila umbellata* and *Quercus sadleriana.* Stands are relatively even-aged; fire has been an important factor in determining stand structure of this type.

This forest is analogous to the *Abies concolor/Chimaphila umbellata* type described by Sawyer and Thornburgh (1977). The description given below for the *Shasta red fir/princes pine forest* is generally applicable, the primary distinction being the greater importance of Shasta fir.

White fir/pinemat manzanita forest. The *White fir/pinemat manzanita forest* (*Abies concolor/Arctostaphylos nevadensis*) is represented by only a small patch in the northeastern corner, on a hot, steep slope above Cub Creek (Plate 1). The type has no equivalent in the Red Fir Zone in the study area. Douglas-fir and sugar pine dominate the overstory, and white fir the understory. Pinemat manzanita may have up to 50% cover, with the remaining ground surface mostly exposed. Soil here is poorly developed and rocky. This slope is the only location for *Collinsia linearis* (CNPS List 4) found in the area. Typical species include:

Silene campanulata	*Arctostaphylos patula*
Chrysolepis chrysophylla	*Arctostaphylos nevadensis*
Apocynum androsaemifolium	*Eriogonum nudum*
Polystichum imbricans	*Collinsia linearis*

Red Fir Zone. Approximately 80% of the study area represents the Red Fir Zone, defined here as forest in which Shasta fir is dominant in either overstory or understory. In general, the importance of Shasta fir in the overstory declines significantly below about 4900'. The only type in which Shasta fir is dominant in the overstory is the *Shasta red fir/thinleaf huckleberry forest*, apparently not subject to frequent or intense fire. In absence of fire, Shasta fir will likely increase in importance over most of this zone. Whether this ever occurs remains to be seen. As Wilderness, the current policy is to allow natural fires to burn. It may be that much of this forest will never contain a significant amount of Shasta fir.

Four forest types are described for the Red Fir Zone. In addition, the wet and dry meadow types, and a scrub type are described, although not necessarily restricted to this zone.

Shasta red fir/thinleaf huckleberry forest. The *Shasta red fir/thinleaf huckleberry forest* (*Abies magnifica/Vaccinium membranaceum*) covers an estimated 110 acres, and is best developed in the canyons near Cub and Haypress Creeks; in the vicinity of Jawbone Camp; and on some of the upper north-faced slopes of the area (Plates 2-4). Elevation is normally above 4900', but drops to as low as 4500' along Cub Creek. Substrate is usually rocky and moist. The overstory is dominated by Shasta fir, but often includes mountain hemlock as a subordinate, occasional Douglas-fir, white fir, Brewer spruce, western white and lodgepole pines. The shrub layer is generally dense, dominated by sadler oak and thinleaf huckleberry. The ground layer is variable, but usually includes *Gaultheria ovatifolia* and *Rubus lasiococcus*. This is the only community that *Pyrola asarifolia* occurs in, although infrequently. A former sensitive species, *Lupinus tracyi*, is also restricted to this community in the vicinity of Jawbone Camp. Some species typically found in this type include:

Vaccinium membranaceum	*Achlys triphylla*
Quercus sadleriana	*Chimaphila umbellata*
Gaultheria ovatifolia	*Maianthemum stellatum*
Rubus lasiococcus	*Paxistima myrsinites*
Clintonia uniflora	*Arctostaphylos nevadensis*
Linneae borealis	*Sorbus californica*

This forest is broadly characterized by Sawyer and Thornburgh's *Abies magnifica/Linneae borealis* type (1977), and is similar to both the Mountain hemlock/sadler oak and Shasta fir-brewer spruce/thinleaf huckleberry forest types described for the Six Rivers National Forest (Jimerson 1986).

Site productivity for Shasta fir is estimated to be moderate, equivalent to

Dunning's Site Class II or III (80-102' @ 100 years), based on Mixed Conifer Site Class curves. Basal areas were intermediate for Red Fir Zone stands, ranging 160 to 320 square feet per acre (sfa). Shasta fir is all size-classed, but normally ranged 35-50" dbh in the overstory. One individual was 57" dbh, 400+ years old, and 160' tall. Mountain hemlock reaches its greatest importance along Haypress Creek, but is normally subordinate to Shasta fir. Hemlock is usually less than 20" dbh, with some trees exceeding 30" dbh and 275 years old.

The stand adjacent to Jawbone Camp, near Albers Meadow, is interesting in that it appears to represent a chronosequence of forest invasion into the meadow (Plate 5). The oldest portion of the stand is 100 years old, and still retains a significant amount of lodgepole and western white pine in the overstory, which appear to be seral components in this community. The water table is variable (-15" deep in June, >3' in July), but is apparently low enough, or sufficiently ephemeral to allow stand development.

The *Shasta red fir/thinleaf huckleberry forest* is usually replaced by the *Shasta red fir/sadler oak forest* at its upper limit, and the *Shasta red fir/princes pine forest* in more xeric situations. Nice examples of this forest occur along the Stanshaw Trail above 5000', and on north-faced slopes just west of the study area.

Shasta red fir/sadler oak forest. The *Shasta red fir/sadler oak forest* (*Abies magnifica/Quercus sadleriana*) dominates upper slopes and ridgetops of the area at elevations above 4900', covering about 140 acres (Plate 6). Although Shasta fir is usually subordinate to white fir, ranging from <5 to >50% of the overstory, it is usually dominant in the regeneration. Douglas-fir and sugar pine are common. This type has the most open canopy of the Red Fir Zone types, normally less than 60% canopy cover. Stands usually contain many snags and down logs, root mounds, and other evidence of fire (Plate 7). Sadler oak ranges 60-90% cover, forming dense stands. A few species occur in the understory, these being:

Chimaphila umbellata	*Arctostaphylos nevadensis*
Apocynum androsaemifolium	*Symphoricarpus mollis*
Rosa gymnocarpa	*Penstemon anguineus*
Pyrola secunda	*Rhamnus purshiana*

This type is similar to the Shasta fir/pinemat manzanita-sadler oak type described on Six Rivers National Forest (Jimerson 1986).

Productivity appears to be low in this type, due to low conifer density. Dominant white fir and Shasta fir are often 40-50" dbh, but basal areas usually range less than 200 sfa. Douglas-fir was measured as large as 82" dbh, and over 500 years old. This type appears to be transitional between the moist, cool *Shasta red fir/thinleaf huckleberry forest*, and the warm, dry *Shasta red fir/princes pine forest*. An especially nice old growth stand occurs east of Ross Meadow #1.

Shasta red fir/vanilla leaf forest. The *Shasta red fir/vanilla leaf forest* (*Abies magnifica/Achlys triphylla*), like the equivalent type at lower elevation in the White Fir Zone, occupies moist, north slopes and the borders of meadows (Plate 8). Elevation ranges from about 4700' to nearly 5400' in the northwestern corner. Soils are well-developed, often rocky, and usually moist. One soil was found saturated at 10". Boulders are common at the surface. This is one of the two most common types in the area, covering about 310 acres, although the actual coverage is difficult to estimate since much of the forest occurs in narrow bands around meadows. Overstory is primarily white fir, with Shasta fir, Douglas-fir, incense cedar and sugar pine contributing lesser amounts. Shasta fir is the primary species regenerating. Stands may be even or

uneven-aged, but show less impact from fire than either the *Shasta red fir/princes pine* or *Shasta red fir/sadler oak* forests. Shrub and herb layers are the most diverse of any of the types present. Some of the typical species include:

Achlys triphylla
Fragaria vesca
Bromus vulgaris
Trillium ovatum
Linneae borealis
Clintonia uniflora
Rubus lasiococcus
Acer glabrum
Gaultheria ovatifolia
Penstemon anguineus
Mahonia nervosa
Stellaria jamesiana
Goodyera oblongifolia
Adenocaulon bicolor
Pyrola secunda
Viola glabella
Chimaphila menziesii
Symphoricarpus mollis
Anemone deltoidea
Maianthemum stellatum
Rosa gymnocarpa
Vancouveria hexandra
Whipplea modesta
Penstemon laetus
Ribes lobbii
Disporum hookeri
Pyrola picta
Rubus parviflorus

This forest is broadly characterized by the *Abies magnifica/Linneae borealis* type described by Sawyer and Thornburgh (1977).

Productivity is probably the highest of any type present, given the high basal areas (generally >300 sfa). Dunning Site Class is estimated II to III. Overstory Shasta and white fir generally range 30-50" dbh. Occasional sugar pine and Douglas-fir are >75" dbh. Many of the larger trees occur at the edges of meadows, perhaps protected from fire.

Shasta red fir/princes pine forest. The *Shasta red fir/princes pine forest* (*Abies magnifica/Chimaphila umbellata*) is the other most common type in the area, covering about 310 acres at elevations above about 4700' (Plate 9). As described, this forest is variable, and includes stands with substantial sadler oak cover; these stands may represent a distinct type, but were not sufficiently distinct within the area to recognize as such. Typical forest includes white fir as the dominant overstory, with Shasta fir, Douglas-fir, sugar pine and incense cedar as secondary elements. Ponderosa and Jeffrey pine are rare. Shasta fir usually dominates regeneration. In well-developed stands, the understory consists of scattered mats of *Chimaphila umbellata*, with up to 40% cover or more, and an open shrub layer composed of *Quercus sadleriana*, *Rhamnus purshiana* or *Rosa gymnocarpa*. *Lilium washingtonianum* is common, but probably seeds in from nearby openings since it never seems to flower in this forest. Some of the typical species that occur with low cover include:

Chimaphila umbellata
Pteridium aquilinum
Hieracium albiflorum
Pyrola secunda
Chrysolepis chrysophylla
Quercus sadleriana
Symphoricarpus mollis
Arctostaphylos nevadensis
Corallorhiza maculata
Campanula prenanthoides
Corylus cornuta
Trientalis latifolia
Viola sheltonii
Apocynum androsaemifolium
Rhamnus purshiana
Rosa gymnocarpa
Lilium washingtonianum
Penstemon anguineus
Phlox adsurgens
Achlys triphylla
Stellaria jamesiana

This forest is broadly characterized by Sawyer and Thornburgh's type of the same name (1977).

Overall site productivity appeared to be relatively high, perhaps second only to the *Shasta red fir/vanilla leaf forest*. Dunning Site Class probably ranges II to III for Shasta fir; and combined with the high conifer basal areas (range usually 260-360 sfa) indicates productive sites. Some of the largest trees encountered were in this type, including Douglas-fir greater than 60" dbh.

The extensive fire history seen in this type is complex and has many interesting aspects. Overall, this type appears to have been influenced by intense fire more than any other type present, resulting in a range of even-aged stands, dating to 35, 65, 105, and 165 years ago. Frequency for intense fire appears to be roughly 30 years, with lighter ground fires undoubtedly more frequent. Many stands are distinctly two-layered, having an overstory >20" dbh, and a lower story characterized by <10" dbh. In these stands, the lower story appears to date to fire about 65 or 105 years ago. In many cases, Douglas-fir, ponderosa pine or incense cedar remain from the previous stand.

Shasta fir appears to be a late seral species in much of this forest, requiring partial canopy for successful establishment. It is difficult to predict whether Shasta fir will ever be a significant element in some young stands on warmer sites, as they begin to open up.

Sadler oak seedlings are common in the dense, depauperate stands of this type, ready to respond when the canopy opens. In general, Sadler oak only seems to form dense stands when there is <300 sfa basal area, or <60-70% canopy closure, suggesting either a time or fire relationship between this type and the closely related *Shasta red fir/sadler oak forest*.

An interesting example of this type occurs near Haypress Meadows, which is nearly 200 years old and yet still exhibits no understory (Plate 10). In this case, factors other than dense overstory canopy may be responsible for the depauperate understory, such as poor soils, moisture limitations, or frequent fire. Deliberate or accidental fires appear to have been a common feature in the area around the meadows, perhaps intended to increase quality or quantity of range land.

Tobacco brush-Greenleaf manzanita scrub. The *Tobacco brush-greenleaf manzanita scrub* (*Ceanothus velutinus-Arctostaphylos patula*) is probably a seral stage to either the Shasta red fir/sadler oak or Shasta red fir/princes pine forest, but appears to take decades or more to develop into forest. This scrub is associated with relatively recently burned patches on ridgetops or steep southern slopes. Total area covered is less than 6 acres. In most cases, conifer regeneration is poor. Soils are poor, and overall conditions are harsh. Typical species include:

Ceanothus velutinus	*Anemone deltoidea*
Arctostaphylos patula	*Quercus sadleriana*
Arctostaphylos nevadensis	*Lilium washingtonianum*
Chrysolepis chrysophylla	*Rhamnus purshiana*
Apocynum androsaemifolium	*Penstemon anguineus*

Pussypaws/western needlegrass dry meadow complex. The *Pussypaws/western needlegrass dry meadow complex* (*Calyptridium umbellatum/Stipa occidentalis*) includes a variety of types that occur in the vicinity of Haypress Meadows, in areas that probably were heavily grazed by cattle in the past (Plate 11). Extensive cattle grazing in the area is alluded to by Arnold and Reed (1980), who were understandably disturbed at having to follow some 500 head of cattle, herded along the Haypress Trail about 1908. The most disturbed areas are characterized by a uniform sandy, well-drained soil with no evidence of an A or B horizon. The typical herb layer in these areas consists of 30% cover *Calyptridium umbellatum*, 50% *Lupinus albicaulis*, and occasional *Carex* spp.,

Eriogonum umbellatum, and *Stipa occidentalis*. More mesic sites have greater species diversity. In many cases, lodgepole pine or Shasta fir are invading along the edges of the Shasta fir or white fir forest (Plate 12). Some representative species include:

Lupinus albicaulis	*Penstemon laetus*
Stipa occidentalis	*Linanthus nuttallii*
Carex rossii	*Pteridium aquilinum*
Eriogonum umbellatum	*Gayophytum nuttallii*
Sanicula graveolens	*Phacelia mutabilis*
Ipomopsis aggregata	*Carex halliana*
Monardhella odoratissima	*Rumex acetosella*

Carex halliana is apparently quite rare in California (CNPS List #2), and occurs in several of the barren areas.

Wet meadow/riparian complex. The *Wet meadow/riparian complex* refers to a broad range of vegetation types found in the wet meadows and along the streamside corridors of the area. Overall, an estimated 137 acres of wet meadow occur within the study area, of which about 82 acres is covered by dense *Alnus* scrub. Vegetation varies according to depth of water table, slope, microclimate, or soils. Most of the openings in the northern half of the study area are dominated by dense *Alnus viridus* or other shrub species, while meadows in the southern half of the area are more diverse. This vegetation is grouped into four broad categories:

Alnus scrub--essentially impenetrable thickets including *Alnus viridus*, *Salix spp.*, *Cornus stolonifera*, *Sorbus californica*, *Ribes marshalli*, *Rhododendron occidentale*, *Acer glabrum*, *Prunus emarginata* and a rich variety of understory forbs and graminoids (Plate 13);

Vaccinium meadow--open meadow, generally only a few inches above the water table (in June); dominated by *Vaccinium uliginosum* and a variety of forbs and graminoids (Plate 14);

Carex meadow--the most common open wet meadow type, with exceptionally high species diversity (Cover photo; Plate 15). This meadow appears to be saturated for much of the year. The wettest areas, often dominated by *Carex rostrata*, are under water much of the year. Mosses are an abundant feature of this type, particularly in the Haypress Meadows. Some of the most common mosses include *Sphagnum spp.*, *Philonotis* spp., and *Dichodontium pellicidum*. This meadow type includes many spectacular plants such as *Pedicularis attollens* and *Dodecatheon alpinum*. A few of the common species include:

Pedicularis attollens	*Carex rostrata*
Dodecatheon alpinum	*Scirpus congdonii*
Lupinus polyphyllus	*Glyceria elata*
Gentiana setigera	*Caltha leptosepala*
Viola macloskeyi	*Ranunculus gormanii*
Ranunculus populago	*Orthocarpus copelandii*
Veratrum viride	*Veratrum californicum*
Lilium wigginsii	*Lotus oblongifolius*

Helenium meadow--the driest of the wet meadow types, often characterized by dense stands of *Helenium bigelovii*, *Castilleja miniata* and other herbs and graminoids (Plate 16).

An estimate of the relative cover of these broad meadow types in the largest meadows is described below:

Table 4. Relative cover of the wet meadow vegetation types for the larger wet meadows, proposed Haypress Meadows RNA; see Figure 2 for location.

Meadow	% of meadow			
	Alnus	*Vaccinium*	*Carex*	*Helenium*
Ross Meadow #1	50	20	25	5
Ross Meadow #2	80	1	5	15
Albers Meadow	60	10	25	5
Lone Pine Meadow	50	5	40	5
Haypress Meadow #1	60	2	33	5
Haypress Meadow #2	30	5	60	5
Unnamed meadow #1	70	5	20	5

The dense *Alnus* thickets appear to be most prevalent on slopes exceeding 10-15%, in areas of abundant--nonstagnant water. All of the larger meadows in the southern half include some *Alnus scrub*, generally in the meadow arms that penetrate upslope into surrounding forest.

The successional dynamics of these meadows are of interest, particularly as they might relate to the reduction in grazing pressure brought about over the last several decades. *Alnus* thickets may be advancing on the wet meadows, although this is not apparent from casual observation of the age structure of alder along the edges of the meadows, nor from the general restriction of *Alnus* to slopes. Lodgepole pine is invading Albers and Haypress Meadows, but this species appears to be quite sensitive to high water table. Invasion of Haypress Meadows generally occurs where the water table was greater than 12" deep in June. A group which had previously invaded Haypress Meadow #2 had all died (Cover photo), perhaps after a series of wet years. Mountain hemlock, Shasta fir, white fir, incense cedar and western white pine all are invading portions of some of the meadows, but also appear restricted by water table. As a result, the boundaries of most meadows appear to be somewhat stabilized. Much of the conifer invasion dates to 15-20 years ago, perhaps related to reduction in grazing pressure.

The best developed riparian corridors are located along Cub Creek and Haypress Creek at the southern boundary, perhaps totalling two miles in length. Overstory varies, and may be pure mountain hemlock or Shasta fir, or include occasional western white pine, western yew, or lodgepole pine. The shrub layer is generally dense with *Salix spp., Cornus stolonifera, Sorbus californica,* and other shrubs. Ground vegetation is diverse, often dominated by *Oxalis oregana, Senecio triangularis, Carex spp., Juncus spp., Glyceria elata, Viola spp., Streptopus amplexifolius, Mitella spp., and other wet ground species. Rubus lasiococcus* and *Gaultheria ovatifolia* often increase in the riparian zone or at the edge of wet meadows.

Wildlife

The area appears to be particularly rich in both wildlife diversity and abundance. Numerous Black Bear, Black-tailed Deer, Blue Grouse and a few Gray Fox and Coyote were seen or heard during the survey. Bear wallows were frequently encountered in the wet meadows, and gopher activity was common in many of the dry meadows.

A detailed wildlife survey was not conducted. However, wildlife densities and diversity should be high due to the high compositional and structural

diversity present in the vegetation types found in the area, and the abundance of water. The wet meadows and adjacent forest probably support the greatest array of wildlife species. These areas constitute a large proportion of the study area (Table 2).

Several sensitive-listed species occur, or probably occur within the area. A pair of Northern Spotted Owls use the area extensively on a seasonal basis, and several other pair have been seen in the general vicinity (Tilghman 1988). Habitat preferred by these birds appears to include the streamside corridor along Cub Creek, the wet meadows, and some older forest stands that likely support Northern Flying Squirrel or other small rodents that serve as a food source. Goshawk and Fisher are probably present (Taylor 1988); Wolverine and Red Tree Vole are potentially present. Other typical species that probably occur include: Bobcat, Allens Chipmunk, Pinyon Mouse, Red-backed Vole, Spotted Skunk, and possibly the Striped Skunk. Mountain Lion have been seen in the vicinity.

FACTORS RELATING TO ESTABLISHMENT

Access

Access by road is available to within .25 miles of the western boundary of the study area. A short cross-country hike from this point, or hikes ranging from 0.5 to 2.0 miles on the various trails that penetrate the area ensure relatively convenient access to most of the area (Figure 1). The ease of access should satisfy the requirements imposed by most kinds of research.

Recognition of boundaries

Except for a short section at the northeastern corner, the area boundaries are easy to recognize in the field, and should present no obstacle to future research or management in the area.

The western and southern boundaries, and the eastern boundary as far north as the middle of Long Meadow, all coincide with well used trails. In some cases, the trails split and proceed both through and around the meadows, particularly on the west side. From the standpoint of reducing pedestrian impacts in the meadows, and maintaining suitability for future research, these trails should be maintained only around the meadows.

The northern boundary follows the recently surveyed Wilderness boundary, and is marked with K tags.

There may be some confusion in identification of the boundary in the northeastern corner of the area where it does not follow a trail, Wilderness boundary, or other easily definable feature. This unmarked portion of the boundary was, for the purpose of this survey, assumed to run north-south across the small knob. Such a demarcation should generally be recognizable topographically, using the slope aspect.

Representation of SAF type 207 (Red fir)

Although applicable in many respects, the SAF description for type 207 does not fit the Klamath Mountains Shasta fir forests as well as forests of the Sierra Nevada and Cascades (Eyre 1980; Sawyer and Thornburgh 1977).

SAF type 207 makes no distinction between red fir and Shasta red fir. Red fir is often the only major overstory component in these forests, and is the climax species. The tree responds to disturbance by producing pure even-aged stands. Growth is highly variable. When present, typical co-dominants are

mountain hemlock, western white and jeffrey pine at higher elevations, and sugar pine and white fir at its lower limit. The understory is generally sparse, and openings are often dominated by lupines and grasses. Recently burned areas are dominated by shrubs including greenleaf manzanita, snowbrush and bush chinquapin.

Approximately 1015 acres, or 80% of the study area is considered Red Fir Zone forest (Table 2), the remainder being White Fir Zone. Within the Red Fir Zone, Shasta fir is dominant in both overstory and understory on only about 110 acres (i.e., the Shasta red fir/thinleaf huckleberry forest). The majority of stands included here as Red Fir Zone contain less than 50% Shasta fir relative cover in the overstory, and often as little as 5-10%. However, given the abundance of Shasta fir regeneration, and *in the absence of severe fire*, these stands will most likely progress toward Shasta fir forest overtime.

While the current representation of "pure" Shasta fir forest from the standpoint of the type #207 description is relatively small, the variety of plant communities in which Shasta fir is a component is broad. This aspect may be more indicative of typical Shasta fir forest in the Klamath Mountains, reflecting the overall high species diversity. In many cases, Shasta fir is represented in communities where it is not dominant by exceptional pockets of old growth trees. Additional prime old growth Shasta fir, white fir and incense cedar occur surrounding many of the wet meadows, and prime old growth Douglas-fir occurs scattered on some of the ridges. In summary, the study area offers a good representation of Shasta fir across its lower elevational range, and across the range of environmental conditions on granitic soils in the Klamath Mountains.

Preponderance of disease

Some of the more common insect pests and diseases in red fir include dwarf mistletoe, Cytspora canker, annosus root disease, Indian paint fungus, fir engraver, and the flat-headed and round-headed fir borer (Markstrom and Jones 1975). No obvious evidence of these maladies was detected in most of the stands, although fire-weakened trees and heart rot are common throughout.

The most apparent disease problem was dwarf mistletoe infection of Douglas-fir, which was most severe in the northern half of the study area on the north-facing slopes above Cub Creek.

General habitat diversity

Habitat diversity is exceptionally high in this area, given the narrow elevational band and uniform geology of the area. This diversity is largely a function of the abundance of water, extensive fire history, and generally, the range in structural characteristics found within the various plant communities present. A variety of wet and dry meadow types are present. Forests range from the relatively open *Shasta red fir/princes pine*, which is almost totally barren in earlier stages, to the very lush groundcover of the *Shasta red fir/vanilla leaf forest*, and almost impenetrable shrub layer in the *Shasta red fir/Sadler oak forest*. Recently or severely burned harsh sites are dominated by impenetrable *Tobacco brush-greenleaf manzanita scrub*, while several miles of stream corridor contain lush riparian vegetation.

The high degree of species and habitat diversity contained in the study area is representative of Klamath Mountains vegetation, and should be represented in the RNA system.

Other significant attributes and research opportunities

Some other characteristics of the area which clearly favor establishment of this RNA include:

1) The broad range of wet meadow types found in the study area, and the exceptional diversity and development of some of these meadows is probably the best, from the standpoint of accessibility, to be found in the Marble Mountains;
2) The extensive grazing history in this area, followed by reduction in grazing several decades ago, offers exceptional opportunities for study of successional dynamics in the degraded meadows;
3) Wildlife diversity appears to be exceptionally high;
4) Shasta fir is represented across its lower elevational range, providing opportunity for study of structural and compositional characteristics of stands in which it is a member, over a range of conditions, but with uniform parent material and regional climate;
5) The area in general represents a complex matrix of fire intensities and frequencies. This is probably indicative of upper montane forests in this region, and provides opportunities for research on the various influences of fire in red fir and white fir forests.

The proposed RNA is suitable for numerous areas of research. Perhaps foremost in this respect involves the characteristics and long-term stability of the meadows, as relates to historical grazing practices and fire history, and the potential for invasion by conifers or *Alnus viridus*. The area has previously supported research on fungal communities associated with mountain hemlock (McLauchlin 1984), moss flora (Spjut 1971), stand dynamics of Shasta fir (Regalia 1978) and wildlife habitat relationships pertaining to Northern Spotted Owl. Examples of other research that could be accomodated by this RNA include:

1) Meadow recovery processes after long-term and extensive grazing pressure;
2) The extent of soils loss in meadow and forest types as a function of grazing and fire history;
3) The soils, moisture, and general successional relationships of mountain hemlock, lodgepole pine, western white pine and Shasta fir in montane meadows, and the importance of grazing and fire history.
4) Factors governing *Alnus viridus* invasion into the wet meadows;
5) The effects of varying fire intensity, frequency and seasonal timing on red fir forest structure and composition;

Factors against establishment

Three factors are viewed as arguments against establishment of this area as a Research Natural Area:

1) Forest in which Shasta red fir is the dominant species constitutes only a minor portion of the area. To a large extent, this shortcoming may be offset by: the diversity of plant associations and environments in which Shasta fir does occur, representative of its lower elevational range in this region; by the presence of exceptional old growth Shasta fir, although patchy, in much of the area; and by the abundance of rich wet meadows which exhibit various stages of red fir invasion.
2) As an established Wilderness Area, utilization of the area for research purposes could present some conflicts. Any proposed research must first be approved by the Regional Forester, as opposed to approval at the Forest level for research in RNAs outside of wilderness. Since under Forest Service policy, the management of any area is subject to the most restrictive regulation, it is conceivable that some restrictions may be placed on the kinds of research

possible; for most purposes this should not be a problem.
3) Perhaps the greatest negative factor is that the area is the focus of publicized and uncontrolled recreational use. The frequency of hiker/camper use in this area is greatest in the vicinity of the wet meadows, and along the trails which form much of the boundary. As such, research in most of the meadows would be subject to impacts by recreationalists. Potential impacts include direct vandalism to equipment, or indirect impacts such as reduced wildlife usage and traffic impacts on vegetation. Most of the *Shasta red fir/thinleaf huckleberry forest* in the area is adjacent to the trail, and therefore subject to the same impacts. Much of the forest, and several large meadows (e.g., Lone Pine Meadow) are relatively remote, and potential for impacts on research in these areas would probably be minor.

RECOMMENDATIONS FOR ESTABLISHMENT

The study area possesses a multitude of unique features which deserve representation in the Research Natural Area system. The factors identified as negative for establishment are significant, but should not prevent establishment of this RNA. Boundary adjustments are possible that could significantly increase suitability for RNA status. ✓

Alternative #1. This alternative (Alternative #1; Figure 4) to the proposed RNA would be to use the Stanshaw Trail (7E10) as the southern boundary for the western half of the area, and extend the western boundary out to the Wilderness boundary. At the same time, the area north and east of Cub Creek could be eliminated, since this forest is predominately white fir, with little impact on representation of Shasta fir forest. The area proposed for inclusion amounts to 400+ acres, while the area proposed for deletion amounts to about 180 acres; the resulting RNA would be in the neighborhood of 1470+ acres.

The area proposed here for addition was not surveyed in detail. However, merits of alternative #2 are judged to be:
1) something in excess of 40 acres of Shasta red fir/thinleaf huckleberry forest would be added, that occurs on northerly slopes in this area, perhaps nearly doubling the amount included in the RNA;
2) the southernmost Albers Meadow, which is an exceptional and diverse wet meadow, would be included;
3) the entire chronosequence of meadow invasion at the eastern edge of Albers Meadow, culminating in the 100-year old mixed Shasta fir/lodgepole pine/western white pine/mountain hemlock stand would be included;
4) elimination of the area northeast of Cub Creek would remove all uncertainty in boundary identification;
5) recreational use in the area to be added, aside from traffic on the Stanshaw Trail, is expected to be minimal.

A negative factor is that the RNA would be bisected by a trail. This is viewed as a minor problem compared to the benefit of adding Shasta red fir/thinleaf huckleberry forest in areas where it is relatively removed from recreational use. The proposed modification serves to partially mitigate two of the three arguments against RNA establishment.

Alternative #2. An even more desirable alternative (Alternative #2; Figure 4) from the standpoint of increasing representation of Shasta fir-dominated old growth forest (and mountain hemlock) would be to include all of the area south of the proposed area, to the Wilderness boundary, and as far east as the Haypress Trail (11W21). This alternative would more than double the size of the

RNA, in excess of 2500 acres, but would include exceptional stands of Shasta red fir. An additional Shasta fir type, the *Shasta red fir/thimbleberry forest* would also be added, that is especially well-developed on south-faced slopes just south of the candidate area.

A third alternative would be to consider establishment of an RNA elsewhere. Potential candidates may occur in the headwaters of the Salmon River, the vicinity of Russian Peak, or the vicinity of Lake Mountain at the northwestern corner of the Marble Mountain Wilderness. However, undisturbed old growth red fir stands either outside of wilderness or readily accessible within wilderness are exceedingly rare. It is possible that no better or more practical candidate RNA exists in this physiographic region for the red fir type.

RECOMMENDATION

Recommendation is made for establishment of the Haypress Meadows Research Natural Area, as proposed in Alternative 1 or 2 above (Figure 4), which serve to mitigate some of the deficiencies in the originally proposed RNA.

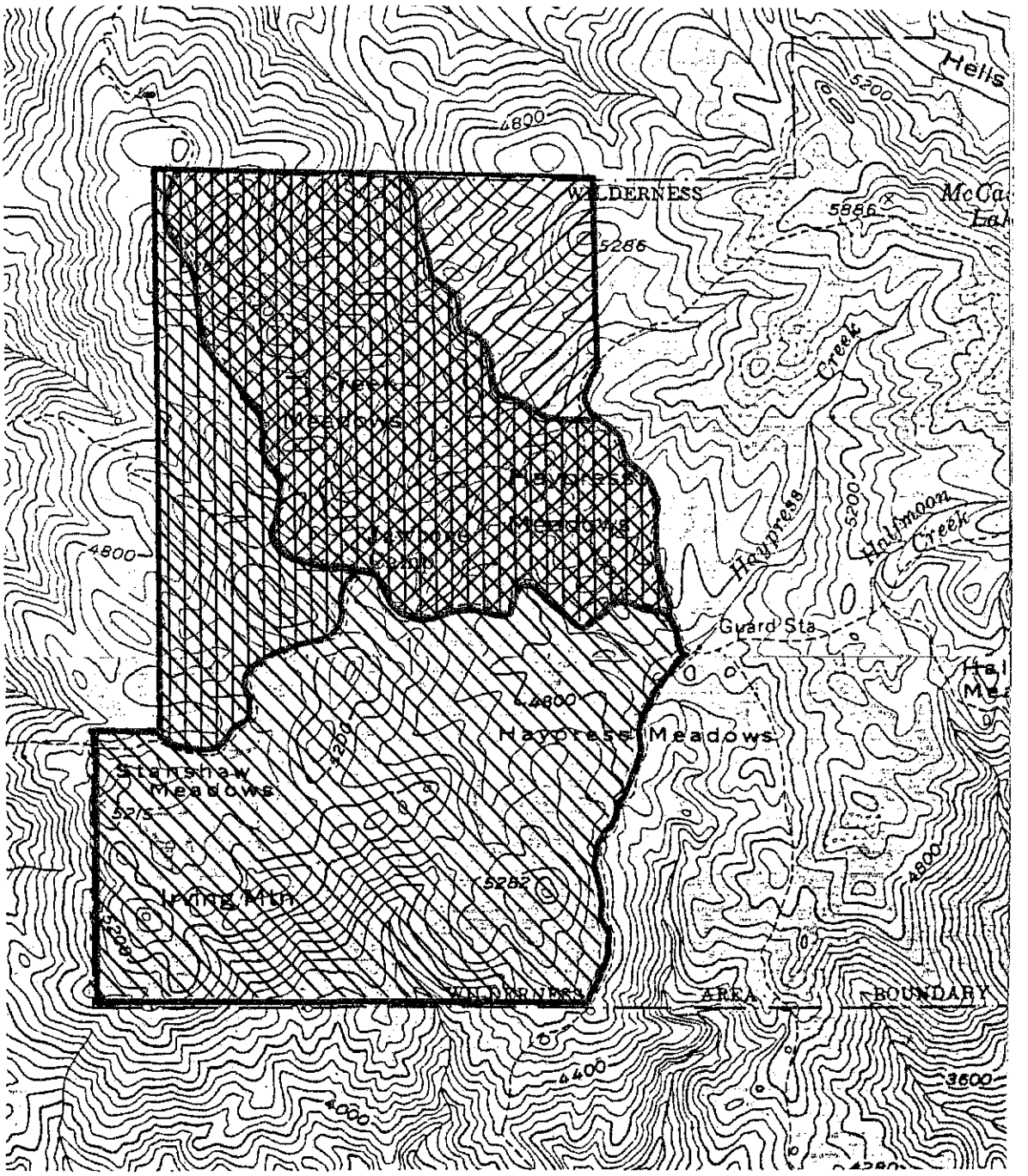


FIGURE 4.
Alternative RNA boundaries; see p.21 for discussion.

KEY

As proposed

Alternative #1

Alternative #2

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APPENDIX A
PLANT SPECIES INVENTORY
PROPOSED HAYPRESS MEADOWS RNA

TREES

Abies concolor
Abies magnifica var. *shastensis*
Calocedrus decurrens
Chrysolepis chrysophylla
Picea breweri
Pinus contorta var. *murrayana*
Pinus jeffreyi
Pinus lambertiana
Pinus monticola
Pseudotsuga menziesii
Taxus brevifolia
Tsuga mertensiana

SHRUBS

Acer glabrum var. *torreyi*
Alnus viridus ssp. *sinuata*
Amelanchier alnifolia
Arctostaphylos nevadensis
Arctostaphylos patula
Ceanothus velutinus
Chrysolepis sempervirens
Cornus nuttallii
Cornus stolonifera
Corylus cornuta
Gaultheria ovatifolia
Lonicera conjugialis
Mahonia nervosa
Paxistima myrsinites
Prunus emarginata
Quercus sadleriana
Rhamnus purshiana
Rhododendron occidentale
Ribes lacustre
Ribes lobbii
Ribes marshallii
Ribes sanguineum
Rosa gymnocarpa
Rubus lasiococcus
Rubus parviflorus
Salix commutata
Salix jepsonii
Salix lasiandra
Sambucus caerula
Sorbus californica
Symphoricarpus mollis
Vaccinium membranaceum
Vaccinium uliginosum ssp. *occidentale*
Vaccinium membranaceum X V. uliginosum

FORBS

Achlys triphylla
Aconitum columbianum
Actea rubra

FORBS continued

Adenocaulon bicolor
Agoseris heterophylla
Allium validum
Anaphilis margaritacea
Anemone deltoidea
Anemone oregana
Apocynum androsaemifolium
Aquilegia formosa
Arnica discoidea
Asarum caudatum
Aster foliaceus
Boschniakia strobilacea
Boykinia major
Cacaliopsis nardosmia
Caltha leptosepala
Calypso bulbosa
Calyptridium umbellatum
Castilleja miniata
Cephalanthera austinae
Cerastium arvense
Chimaphila menziesii
Chimaphila umbellata var.*occidentalis*
Cicuta douglasii
Circaea alpina
Claytonia sibirica
Clintonia uniflora
Collinsia linearis
Corallorhiza maculata
Corallorhiza mertensiana
Corallorhiza striata
Cynoglossum occidentale
Disporum hookeri ssp. *trachyandrum*
Dodecatheon alpinum
Epilobium angustifolium
Epilobium oreganum
Epilobium minutum
Erigeron aliceae
Eriogonum nudum
Eriogonum umbellatum
Fragaria vesca
Galium spp.
Gayophytum nuttallii
Gentiana setigera
Geum macrophyllum
Goodyera oblongifolia
Hackelia californica
Hackelia micrantha
Helenium bigelovii
Hieracium albiflorum
Hypericum anagalloides
Ipomopsis aggregata
Iris purdyi
Lilium washingtonianum ssp. *purpurascens*
Lilium wigginsii
Linanthus nuttallii
Linneae borealis
Listera caurina

FORBS continued

Lotus oblongifolius
Lupinus albicaulis
Lupinus polyphyllus
Lupinus tracyi
Madia bolanderi
Maianthemum racemosa ssp. *amplexicaulis*
Maianthemum stellatum
Mimulus primuloides
Mimulus moschatus
Mitella caulescens
Mitella diversifolia
Mitella trifida
Monardhella odoratissima
Navaretia divaricata
Nemophila parviflora
Orthocarpus copelandii
Osmorhiza chilensis
Oxalis oregana
Pedicularis attollens
Pedicularis racemosa
Penstemon anguineus
Penstemon laetus
Perideridia oregana
Phacelia mutabilis
Phlox adsurgens
Plantago lanceolata
Platanthera dilatata
Platanthera saccata
Pleuricospora fimbriolata
Polygonum bistoroides
Polygonum douglasii
Polygonum phytolaccaefolium
Potentilla drummondii
Potentilla gracilis ssp. *nuttallii*
Potentilla glandulosa
Prunella vulgaris
Pterospora andromedea
Pyrola asarifolia var. *purpurea*
Pyrola picta
Pyrola secunda
Ranunculus gormanii
Ranunculus orthorhyncus
Ranunculus populago
Ranunculus uncinatus
Rumex acetosella
Sanicula graveolens
Sarcodes sanguinea
Saxifraga oregana
Senecio triangularis
Sidalcea oregana
Silene campanulata
Solidago canadensis ssp. *selebrosa*
Stachys rigida
Stellaria jamesiana
Streptopus amplexifolius
Tiarella unifoliata
Tellima grandiflora

FORBS continued

Trautvetteria caroliniensis
Trientalis borealis
Trifolium longipes
Trillium ovatum
Trillium rivale
Vancouveria hexandra
Vancouveria planipetala
Veratrum californicum
Veratrum viride
Veratrum californicum X V. viride
Veronica americana
Veronica cusickii
Vicia americana
Viola adunca
Viola glabella
Viola macloskeyi
Viola sheltonii
Whipplea modesta

FERNS AND ALLIES

Athyrium felix-femina
Equisetum spp.
Polystichum munitum
Polystichum imbricans
Pteridium aquilinum

GRASSES AND ALLIES

Agrostis alba
Agrostis idahoensis
Agrostis spp.
Bromus vulgaris
Carex ablata
Carex fracta
Carex halliana
Carex laeviculmis
Carex rossii
Carex rostrata
Deschampsia cespitosa
Deschampsia elongata
Elymus glaucus
Festuca occidentalis
Glyceria elata
Hordeum brachyantherum
Juncus ensifolius
Luzula multiflora ssp. comosa
Luzula divaricata
Poa pratensis
Phleum alpinum
Phleum pratense
Scirpus congdoni
Scirpus microcarpus
Stipa occidentalis var. californica
Trisetum cernuum

APPENDIX B

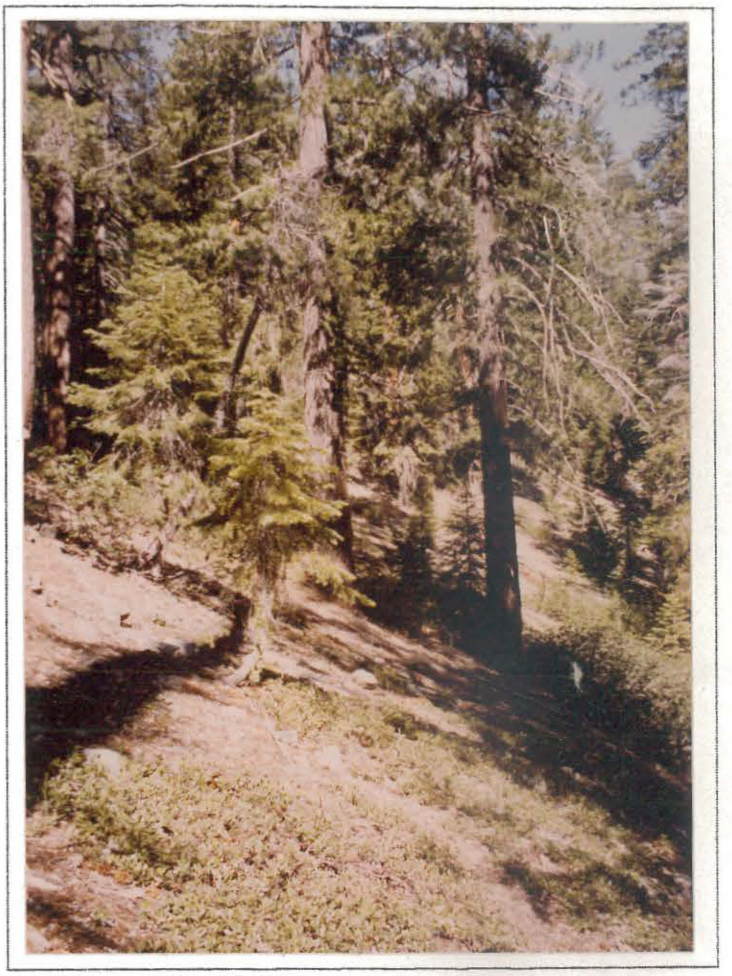

PLATE 1. *White fir/pinemat manzanita forest* on a steep dry slope at the northeastern corner of the area; characterized by *Arctostaphylos nevadensis, Eriogonum nudum, Silene campanulata, Apocynum androsaemifolium, Polystichum imbricans, Chrysolepis chrysophylla* and *Collinsia linearis*.

PLATE 2. *Shasta red fir/thinleaf huckleberry forest*; typical along drainages and on north-faced slopes, primarily in the southern portion of the area; this is the only forest type in which Shasta fir is dominant in the overstory; mountain hemlock is important in some areas.

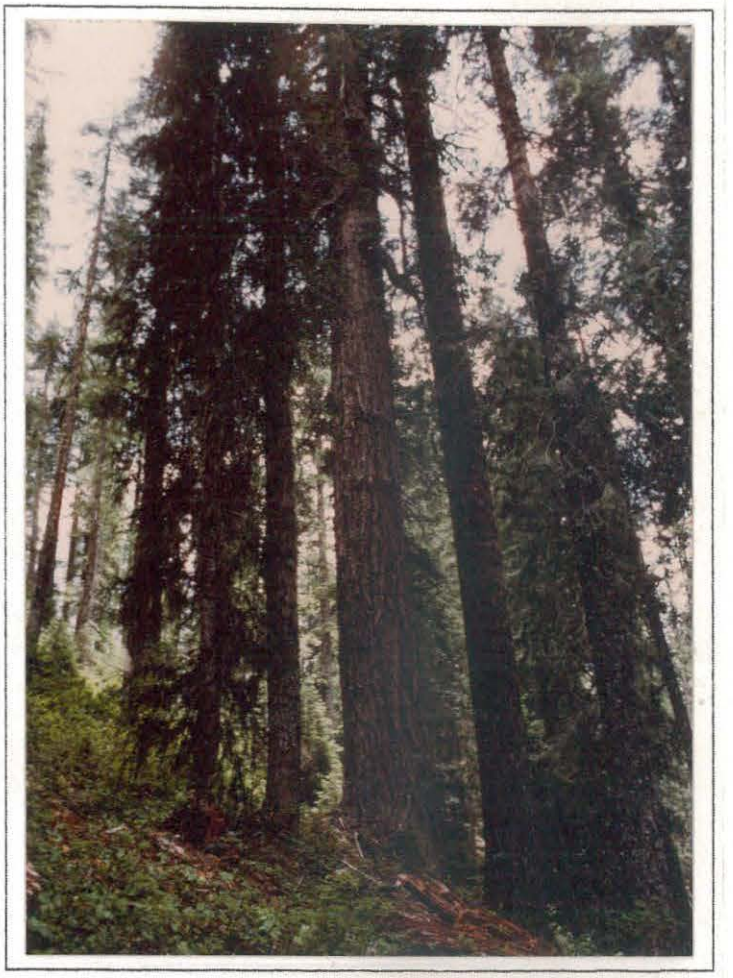

PLATE 3. *Shasta red fir/thinleaf huckleberry forest* on a cool north-faced slope; Douglas-fir (70+" dbh) and Brewer spruce shown; understory includes *Vaccinium membranaceum*, *Quercus sadleriana*, *Gaultheria ovatifolia*, *Linnaea borealis*, *Rubus lasiococcus*, *Sorbus californica*, and others.

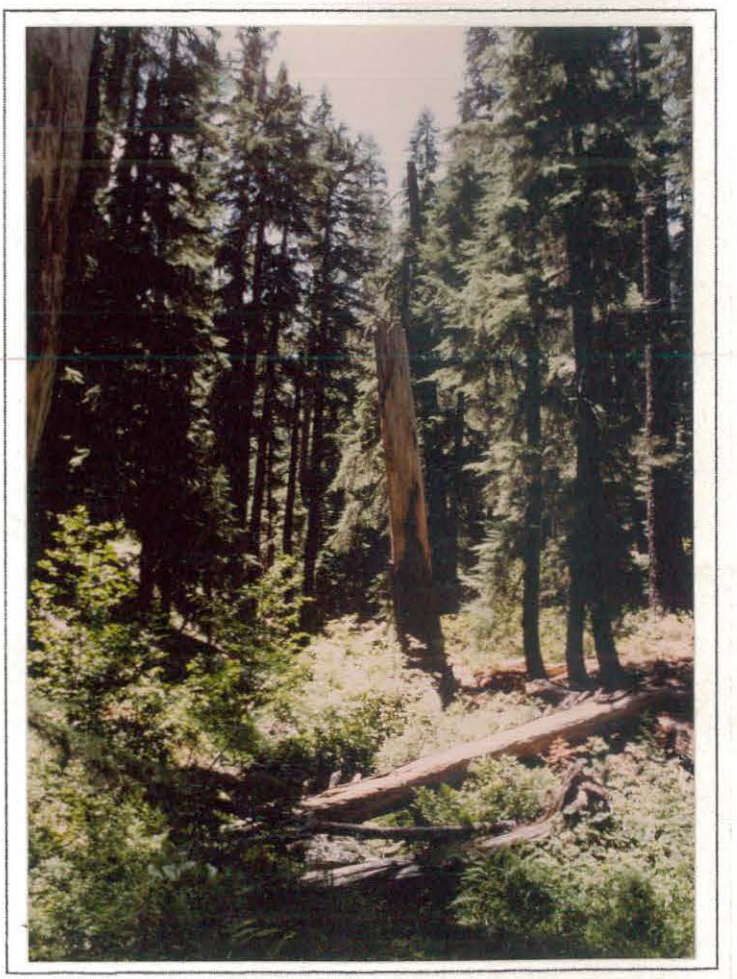

PLATE 4. *Shasta red fir/thinleaf huckleberry forest*; dense mountain hemlock along Haypress Creek at the southern boundary to the area; hemlock ranges up to 30" dbh and 300 years old.

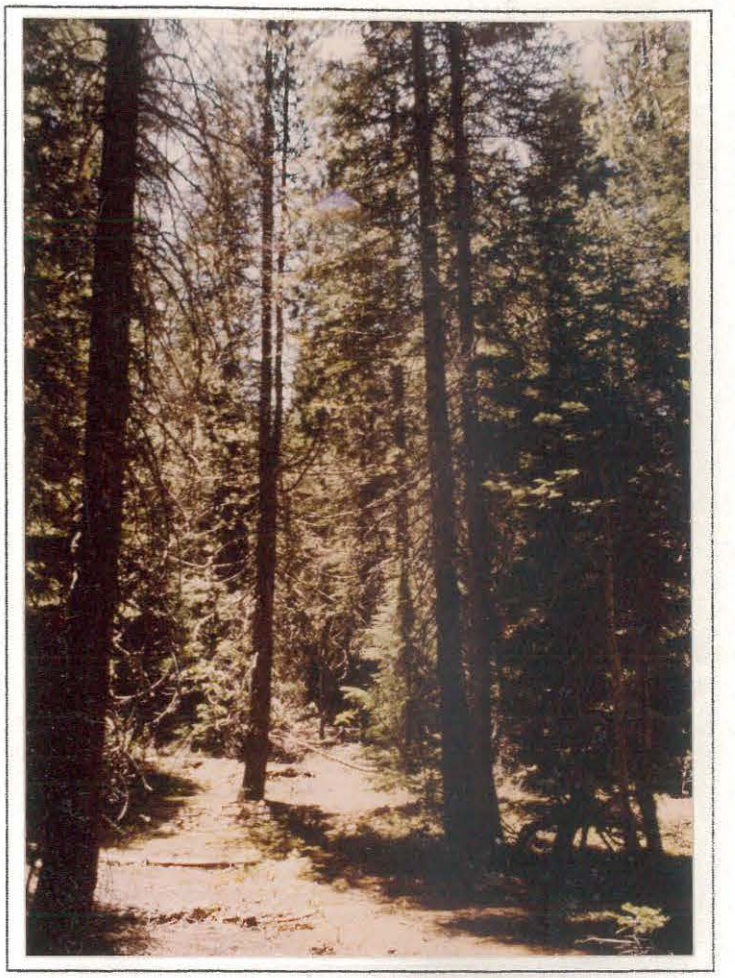

PLATE 5. *Shasta red fir/thinleaf huckleberry forest* on a moist flat near Jawbone Camp; this stand is atypical of the type, and includes lodgepole pine, western white pine, Shasta fir, white fir and mountain hemlock; at 100 years old, this is the oldest stage in what appears to be a chronosequence of forest invasion into Albers Meadow.

PLATE 6. *Shasta red fir/sadler oak forest*; characterized by dense sadler oak and Shasta fir regeneration; overstory is predominately Douglas-fir.

PLATE 9. *Shasta red fir/princes pine forest;* well developed, with a dense ground cover of *Chimaphila umbellata* and scattered *Quercus sadleriana;* overstory generally dominated by white fir, understory by Shasta red fir.

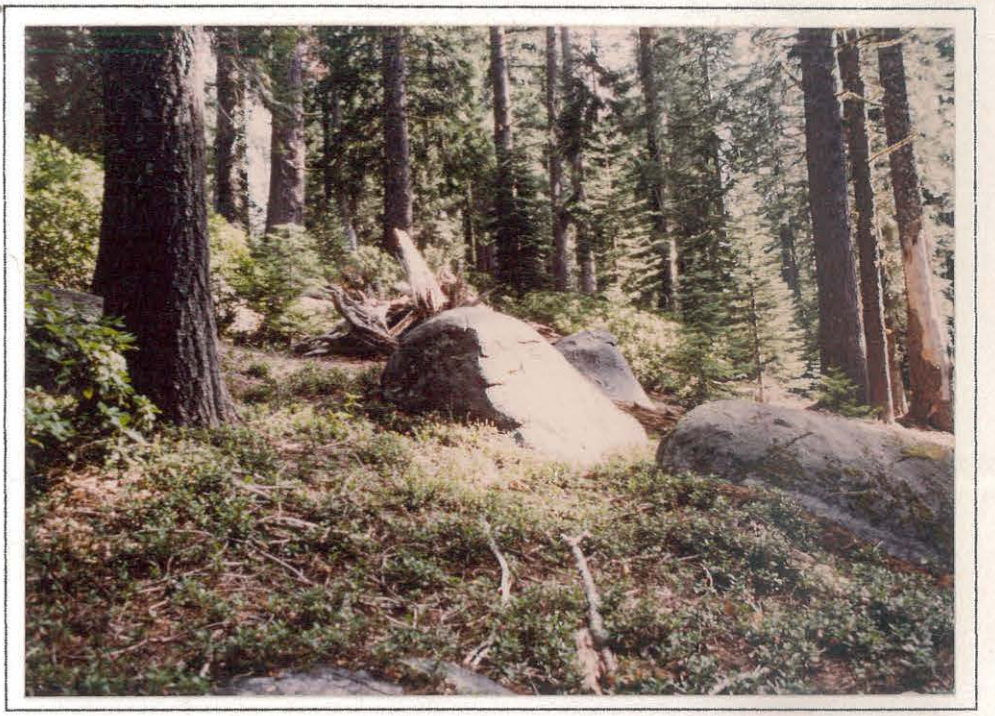

PLATE 10. *Shasta red fir/princes pine forest;* an especially depauperate stand 180 years old near Haypress Meadows; characterized by an occasional *Chimaphila umbellata, Pyrola picta, P. secunda, Penstemon anguineus,* and *Hieracium albiflorum.* This is the warmest and driest of the Red Fir Zone forest types present.

PLATE 11. *Pussypaws/western needlegrass dry meadow* in the vicinity of Haypress Meadows; soils are poorly developed probably due to past grazing practices; typical groundcover is *Calyptridium umbellatum, Lupinus albicaulis, Eriogonum umbellatum, Stipa occidentalis, Carex* spp.

PLATE 12. Lodgepole pine and Shasta fir invasion on eroded banks of Haypress Creek; trees are 15-20 years old, apparently dating to grazing allotment cutbacks in the 1960's.

PLATE 13. Dense *Alnus scrub* on slope above a wet meadow; characterized by *Alnus viridus*, *Cornus stolonifera*, *Sorbus californica*, *Ribes marshallii*, *Prunus emarginata* and a rich understory of forbs and graminoids.

PLATE 14. Largest of the Haypress Meadows, characterized by lush and diverse vegetation; typical species include *Vaccinium uliginosum*, *Carex spp.*, *Juncus spp.*, and many other forbs and graminoids; in the foreground are *Veratrum californicum*, *V. viride*, and the resulting hybrid.

PLATE 15. Haypress Meadow #1; wet meadow is poor quality compared to Haypress Meadow #2; also shown is degraded dry meadow, probably a result of historical grazing pressure and related downcutting of the stream; mountain hemlock, lodgepole pine and Shasta fir are invading the drier portions, and is 15-20 years old.

PLATE 16. Wet meadow in the northern portion of the area, dominated by *Helenium bigelovii* and *Castilleja miniata*.